CONDUIT COUPLING SYSTEM, TOOL AND METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to conduit or pipe couplings, and in particular to a system, tool and method for pushing the ends of a pair of plastic conduit sections into a coupling to form a fluid-tight, pull-out resistant coupling therebetween.

2. Discussion of the Related Art

[0002] Couplings and fittings of various types are used for joining pipes and conduits. Examples include threaded fittings, couplings that are secured with solvent adhesives, weldments and various push-type couplings. The performance criteria for pipe coupling mechanisms are generally determined by such factors as the pipe materials, design pressures, temperature ranges, fluid-tight requirements, pull-out resistance requirements and environmental conditions.

[0003] For example, the nationwide, fiber-optic, telecommunications networks consist largely of buried fiber-optic cables. The cables are commonly protected from groundwater and other subsurface conditions by enclosing them within plastic conduits. A common fiber-optic cable installation procedure involves placing the empty conduits below grade with special trenching and tunnel-boring equipment, whereafter the fiber-optic cables are blown through the conduit with high-pressure air. The plastic conduits and the connecting fittings used in such installations must be impervious to groundwater, resistant to the corrosive effects of soil and capable of maintaining relatively high internal air pressures. Therefore, the

connecting fittings or couplings used for joining the conduit sections require sufficient pull-out resistance to withstand internal air pressures, and further to resist tensile forces tending to separate the conduit sections by pulling apart their connections.

[0004] Conduit coupling systems are commonly used in adverse field and environmental conditions where only minimal equipment is available and speed is relatively important. Therefore, machining and other preparation of the conduit sections ends should be eliminated or minimized. Manually-operated hand tools are generally preferred due to their portability and independence from external power sources. Moreover, the couplings and other fittings should be relatively simple, inexpensive, strong and reliable. Still further, the bores of the aligned conduit sections should be free from obstructions after they are coupled.

[0005] Heretofore there has not been available a conduit coupling system, tool and method with the advantages and features of the present invention.

BRIEF DESCRIPTION OF THE INVENTION

[0006] In the practice of one aspect of the present invention, a coupling system, tool and method are provided for continuously fluidically connecting a pair of conduit sections with a coupling having internal, annular ribs adapted and oriented to pass the conduit section ends one-way into the coupling and to resist pull-out in the opposite direction. The tool comprises a pivotally interconnected pair of lever arms each mounting a respective clamp assembly. Practicing an aspect of the method of the present invention involves clamping the conduit sections with the clamp assemblies, spreading the lever arms to their open position, placing a coupling between the conduit sections ends and closing the lever arms whereby the conduit

section ends are pushed into and fixedly received in the coupling. Pull-out resistance is provided by the coupling internal ribs, which impinge on the conduit sections for securely retaining same in fluid-tight engagement with the coupling.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

[0008] Fig. 1 is a perspective view of a conduit coupling tool embodying an aspect of the present invention, with the conduit sections and the coupling shown in phantom lines.

[0009] Fig. 2 is a front elevational view thereof.

[0010] Fig. 3 is a side elevational view thereof.

[0011] Fig. 4 is an enlarged, fragmentary, cross-sectional view of a clamp assembly and the coupling, taken generally within circle 4 in Fig. 2 and showing the conduit section ends in phantom lines and in position for insertion into the coupling with the coupling tool in its open position.

[0012] Fig. 5 is an enlarged, front elevational view of the clamp assembly on the left and a cross-sectional view of the clamp assembly on the right and the coupling, with the conduit section ends fixedly embedded in the coupling and the coupling tool in its closed position.

[0013] Fig. 6 is an enlarged, side elevational view of a clamp assembly taken generally along line 6-6 in Fig. 4, with the clamp assembly in its closed position.

[0014] Fig. 7 is an enlarged, side elevational view of the clamp assembly in its open position with a conduit section being extracted therefrom.

DETAILED DESCRIPTION OF THE INVENTION

I. Introduction and Environment

[0015] As required, detailed embodiments and/or aspects of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments/aspects are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

[0016] Referring to the drawings in more detail, the reference numeral 2 generally designates a coupling tool adapted for inserting the ends of conduit sections 4, 6 into a tubular coupling 8. Without limitation on the generality of useful applications of the coupling tool 2, the conduit sections 4, 6 can comprise various suitable plastics, such as polyvinyl chloride (PVC) polyethylene, polypropylene, etc. The tool 2 generally comprises a lever assembly 10 and a pair of clamp assemblies 12 mounted thereon.

II. Coupling Tool 2

[0017] The lever assembly 10 comprises a pair of lever arms 13, 14, which are pivotally interconnected by a pivot connector 16. The lever arms 13, 14 include respective, proximal handle ends 18, 20 and distal ends 22, 24, which mount the clamp assemblies 12.

[0018] Each clamp assembly 12 includes a stationary jaw 26 and a movable jaw 28 movably mounted thereon by a hinge 30 attached to the undersides of the jaws 26, 28. The stationary jaw 26 is rotatably mounted on a respective lever arm distal end 22 or 24 by an axle 32, with a coaxial rotational axis 34 extending perpendicularly from the lever arm distal end 22

or 24. The axle 32 is fixedly retained in place in the stationary jaw 26 by an axle retainer screw 33, which extends through the hinge 30, the axle 32 and into the stationary jaw 26 (Figs. 6 and 7). The jaws 26, 28 include respective engagement faces 36, 38 with respective conduit receiver halves 40, 42. With the jaws 26, 28 closed, the receiver halves 40, 42 are positioned in opposed relation to form a conduit receiver 44 (Fig. 6). Each receiver half 40, 42 includes multiple, semi-circular arcuate receiver ribs 46 with sawtooth-shaped cross-sections forming engagement edges 48 adapted for grippingly engaging the conduit sections 4, 6 (Figs. 4 and 5).

[0019] The jaws 26, 28 include respective latch channels 52, 54, which partially receive respective latch mechanisms 56 adapted for selectively latching and tightening the clamp assemblies 12. Each latch mechanism 56 includes a latch bolt 58 with an inner, retained end 60 mounting a cross pin 62 pivotally received in respective cross pin receivers 64 located on opposite sides of the stationary jaw 26 and its latch channel 52. Each latch bolt includes a threaded outer end 66 threadably mounting a knurled nut 68 adapted for manual tightening whereby the clamp assembly 12 securely clamps a respective conduit sections 4 or 6. An alignment mechanism 70 interconnects the clamp assemblies 12 and includes an alignment rod 72, which slidably extends through respective, transverse guide rod passages 74 formed in the stationary jaws 26. The rod 72 includes opposite ends 76 protruding beyond the stationary jaws 26 and mounting retainers 78, which are adapted for limiting the range of motion of the lever arms 13 at their maximum spread (Fig. 2).

III. Coupling 8 and Operation

[0020] In operation, the tool 2 is adapted for inserting the ends of the conduit sections 4, 6 into the coupling 8. The coupling 8 includes a throughbore 80 with first and second sections

81, 82, which are separated by an annular center stop 84 located approximately midway through the throughbore 80. Each throughbore section 81, 82 includes multiple, annular coupling ribs 86 with sawtooth-shaped cross-sectional configurations, which are somewhat similar to the configurations of the clamp jaw receiver ribs 46 (Figs. 4 and 5). The coupling ribs 86 likewise define relatively sharp, annular engagement edges 88, with inside diameters D.1, which are slightly less than outside diameters D.2 of the conduit sections 4, 6. The coupling 8 preferably comprises a relatively hard material, such as polycarbonate, whereby the coupling rib edges 88 impinge on the conduit section outer surfaces, forming a fluid-tight, pull-out resistant sealing connection therebetween. The coupling 8 can comprise a transparent or translucent plastic material adapted for visual observation of the conduit section ends within the coupling. The contents of the conduits, such as fiber-optic cables, fluids and the like, can also be observed through a clear, see-through coupling. Alternatively, the coupling 8 can comprise another suitable material, such as metal. The sawtooth configuration of the coupling ribs 86 functions to permit one-way passage of the conduit sections 4, 6 into the coupling throughbore 80, while resisting pull-out in the opposite direction.

[0021] The conduit sections 4, 6 are placed in the clamp receivers 44 with the clamp assemblies 12 opened (Fig. 7), whereafter the clamp assemblies 12 are securely clamped on the conduit sections 4,6 by tightening the latch mechanism nuts 68 (Fig. 6) whereby the engagement edges 48 of the receiver ribs 46 impinge on the conduit sections 4, 6. With the lever assembly 10 in its closed position, the conduit sections 4, 6 can be properly positioned in the clamp assemblies 12 with their ends touching or nearly touching. The lever assembly 10 is then spread to provide clearance between the conduit section ends for the coupling 8 (Figs. 2 and 4). The

lever assembly 10 provides considerable leverage whereby substantial compressive forces can be applied for securely embedding the conduit section ends in the respective throughbore first and second sections 81, 82. The sawtooth configurations of the clamp receiver ribs 46 function to effectively resist slippage of the captured conduit sections 4,6 and effectively transmit compressive forces, which insert the conduit section ends into the coupling 8. The alignment mechanism 70 rotates the clamp assemblies 12 on the lever arms 13, 14 about the rotational axes 34 whereby the clamp assembly conduit receivers 44 are maintained in axial alignment with the conduit sections 4, 6 and the coupling 8.

[0022] It will be appreciated that the pull-out resistant coupling can be configured in various alternative aspects and embodiments within the scope of the present invention. For example, the tool 2 can be adapted for connecting conduit sections with various other types of fittings, such as reducers, Ts, elbows, etc. Moreover, external hydraulic, electrical or other power sources can be utilized for opening and closing the clamp assemblies.